APPLICATION OF REMOTE SENSING AND STATISTICAL MODELING FOR WATER QUALITY MAPPING IN THE AL-GRIB DAM

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The assessment of surface water quality in artificial dams is a crucial part of the sustainable management of water resources, especially in semi-arid and dry regions where water scarcity is a persistent challenge. Although traditional physical sampling on-site and subsequent laboratory analysis are considered the most exact methods of data collection, they are fundamentally limited in spatial coverage, capturing only isolated snapshots of a large water body. Furthermore, these classical approaches require substantial time, physical effort, and financial budgets. To address these operational limitations, this study investigates the application of a combined methodology integrating optical remote sensing from multispectral satellites with direct ground-truth data to continuously assess the water quality of the Al-Grib dam. During the methodological phase, we conducted structured field campaigns to obtain in-situ measurements of fundamental physicochemical properties—such as turbidity, suspended particulate matter, and other optical water quality indicators—at different strategic points across the reservoir. Synchronously, free multispectral satellite images corresponding to the precise sampling dates were acquired and processed. Through rigorous statistical methods, including regression analysis, we assessed the mathematical correspondence between the field-measured data and the surface reflectance values extracted from the satellite imagery spectral bands. The derived empirical relationships were subsequently utilized in the construction of robust predictive models, allowing major water quality parameters to be accurately estimated and mapped over the entire water surface. Our research findings have clearly demonstrated that the combination of targeted statistical analysis of ground data and satellite remote sensing constitutes a highly dependable technique for visualizing the spatial distribution of water quality. Ultimately, this integrated approach represents a realistic, scalable, and economical decision-support instrument to directly assist local authorities and environmental planners in reservoir management, which in turn means significantly less reliance on extensive, costly, and slow manual field sampling protocols.

Brief Biography: Hamid RAHALI is a dedicated PhD researcher from Algeria, specializing in water resources management, remote sensing, and statistical modeling. His academic research focuses on integrating geospatial technologies with environmental science to develop cost-effective, practical solutions for monitoring and managing dam water quality in semi-arid regions.